DESIGN AND INSTALLATION OF CAMPUS

RADIO FREQUENCY TRANSMISSION SYSTEMS

The transmission system is the unique feature of a campus confined radio station, setting it apart from standard commercial broadcasting stations, and making possible greater freedom of operation under the Rules and Regulations of the Federal Communications Commission as well as permitting greater freedom of expression by the students.

In order to maintain the integrity of each campus station with respect to the law, sound engineering practices must be carefully adhered to, and each campus installation made after careful consideration of the various factors involved. Tests must be conducted prior to formal opening of the system, and from time to time after this, to prove the adequacy of the initial installation, and to indicate and prove needed revisions.

Legality of Wired Wireless Systems.

The Rules and Regulations of the FCC which apply to wired wireless systems are quoted on pages TI3001 and TI3002. FCC press release dated Novemebr 21, 1938 further amplifies Rule 2.102 paragraph (a) with the following footnote "For wired wireless systems the term 'apparatus' is interpreted to mean the nearest point of the conductors carrying the radio frequency currents".

In General Information Release 54846 dated Oct. 24, 1941, the FCC furthur states:

> "In the intercollegiate broadcasting systems communication is effected not by the transmission of radio waves through space but by the transmission of radio frequency currents via wire lines. Radiation of energy from the lines capable of causing interference is prevented by proper shielding of the lines in metal conduit. You may obtain further information regarding the design of such systems from Mr. David W. Borst, Technical Manager of the Intercollegiate Broadcasting System, ..."
>
> "Preliminary investigations have indicated that these intercollegiate systems are well engineered and supervised. No interference has been reported as a result of their use. The Commission has therefore not promulgated and rules governing their operation.
>
> "This type of system, however, if used on

open lines or if improperly designed, is capable of causing very serious interference. The Commission is therefore making a study with a view to the need for regulations in the case of extension of this principle of communication into other fields."

As long as the restrictions on allowable radiation are adhered to, there is no need for a campus station to secure a station license or licenses for its operators. The FCC maintains monitoring stations to facilitate making routine checks or immediate investigations resulting from specific complaints or requests. Stations not complying with the law are forced to close until remedial steps are taken and proved to the Radio Inspector involved.

Design Procedure.

As a guide to organizations installing a campus station the following procedure is recommended:

1) Previous knowledge of the principles of wired wireless transmission should be augmented by reading pages TI3002 through TI3009.

2) A survey of the campus should be conducted to determine which of the several available methods should be chosen. A map of the campus must be secured, and on it the following information noted:

a) Building to house the studios.
b) Buildings housing students (dorms, fraternities, commons.)
c) Location of underground passageways such as steam tunnels.
d) Source of lighting power for each building defined in (b), and type of lighting power (a-c, d-c, voltage, etc)
e) Type of interior wiring in buildings (open or conduit, etc.) and location of central power distribution point(s) in each building (main fuse box or transformer room, etc.)
f) Location of secondary and primary (if a-c) power distribution lines to all buildings defined in (b), and location of distribution transformers.
g) Number and location of off campus buildings served by primary distribution system defined in (f)
h) Location of all streets separating buildings defined in (b).

3) With the above facts established, the basic system layout can be established. Pages TI3003 through

TI3009 describe the fundemental systems involved. Each of these systems is treated in greater detail on later pages, as outlined below:

a) R.F. Distribution over Single Conductor Overhead Lines: This method is not recommended for other than temporary installations in rural areas. Refer to pages: TI3010-13, and TI3030-31.

b) R.F. Distribution Over Single Conductor Underground Lines: This method offers little improvement over a), and is also not recommended. Refer to pages TI3012-13.

c) R.F. Distribution Over Double Conductor Overhead Lines: This method is widely used to couple r.f. into building lighting circuits. Refer to pages TI3014, TI3018-21, TI3030, TI3032-39.

d) R.F. Distribution Over Double Conductor Underground or Shielded Lines: These methods are similar to c) with the advantage of better control of radiation. Refer to references for c) and page TI3021.

e) R.F. Distribution Over Primary Power Circuits: Under certain circumstances distribution may be accomplished over existing power circuits. Refer to pages TI3015-16, TI3030, TI3040-49.

f) R.F. Distribution Over DC Circuits: In general, this method seems limited to a few adjacent buildings as the r.f. on the d-c line attenuates very rapidly. Coupling to the d-c lines is as described for c).

g) Audio Distribution to Several Transmitters: This method is not recommended unless an r.f. line would be very long, or could not be erected because of streets. For student erected audio lines refer to TI3014, TI3017-21. For telephone lines refer to TI3022-25. Each of these transmitters would be coupled to buildings by one of the methods listed in a) through f). The number of transmitters should be kept as low as possible to reduce maintenance problems. A transmitter in each building to be reached is not recommended unless no other means is available.

4) The location of the main transmitter and any additional ones required will depend upon the system layout decided upon. Refer to page TI3037. The power level of each transmitter will also be determined by the system layout. Refer to pages TI3008 and TI3036. If the power level of a transmitter proves too great, the excess can be dissipated in a dummy load, such as an incandescent lamp.

5) Often a system can be broken down into several convenient sections, and the most important sections installed first. An expansion program of this sort should be included in the original plans.

6) The proper method of coupling r.f. to buildings is discussed under each transmission method. Note particularly pages TI3019 and TI3034-36.

7) The transmitter(s) should be designed. Refer to section TI1000. Audio amplifiers feeding lines should be constructed as described in section TI2000.

8) The frequency of operation should be chosen. Refer to pages TI1101 and TI1104-8.

Installation.

As each section of the transmission system is installed careful checks must be conducted to determine the extent of radiation from lines and buildings. Refer to pages TI3009, TI3036, TI3048-49. As indicated, portable battery operated radios do not have enough sensitivity to give more than a rough check. A sensitive communications receiver installed in an automobile and operated from the car battery will give better results, within the limitation of the places the car may be driven. A field strength meter may be available from the college communications laboratory, or from a local broadcasting station.

Maintenance.

A definite policy of checking all transmission circuits and equipment must be established to avoid loss of program time due to equipment failure. Lines must be replaced at intervals between six months and several years depending upon their quality and location. Tubes, electrolytic capacitors, and other equipment items should be replaced at similar intervals to assure continued good performance.